

# NASA TECH BRIEF



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## Crack Detection Method Is Safe in Presence of Liquid Oxygen

**The problem:** Current commercial methods used to detect cracks or flaws in metals require the use of materials which are not compatible with liquid oxygen (i.e., burn when in contact with liquid oxygen). The use of any of these materials, including dyes, penetrants, or emulsifiers, could cause a premature and disastrous explosion during the launching of space vehicles.

**The solution:** Using certain specific chemicals which form precipitates within the crack or flaw and which are compatible with liquid oxygen. By observing the reaction, one is able to detect the crack or flaw with a sensitivity greater than that which present methods provide.

The chemicals used include: aluminum chloride, aluminum nitrate, barium sulfate, copper nitrate, copper sulfide, ferrous chloride, potassium ferricyanide, potassium ferrocyanide, potassium permanganate, and sodium sulfide. Other compounds appear to be usable, but have not yet been tested. The compounds chosen are those which form a minute quantity of colored precipitate within the flaw.

**How it's done:** The sample metal is soaked in or sprayed with the first part of the chemically reactive

mixture. The surface is then rinsed lightly to remove any excess solution. Finally, the sample metal is sprayed with the second part of the chemically reactive mixture.

The site of the crack is detected by observing the colored precipitate of the chemical compound produced from the chemically reactive mixtures.

### Notes:

1. This method may be used in any situation where flaws in metal (especially aluminum) must be detected regardless of the presence of liquid oxygen. This method is also relatively inexpensive.
2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama, 35812  
Reference: B65-10107

**Patent status:** NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: The Boeing Company under contract to  
Marshall Space Flight Center  
(M-FS-236)